Amendments to the Claims:

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

1. (Currently Amended) A method for injecting fuel into a transient exhaust stream of an exhaust system, the exhaust system including a catalytic converter positioned upstream from a diesel particulate filter, the exhaust system also including a fuel dispenser positioned upstream from the catalytic converter, the method comprising:

selecting a control volume within the exhaust system, the control volume including the fuel dispenser and the catalytic converter; and

using a ~~model~~ fuel dispensing formula derived from a transient energy balance equation for the control volume to ~~determining~~ determine a fuel dispensing rate at which fuel is dispensed into the exhaust stream by the fuel dispenser, the fuel dispensing rate being controlled such that combustion of the fuel at the catalytic converter provides a target exhaust gas temperature downstream of the catalytic converter, the target exhaust gas temperature being suitable to cause controlled regeneration of the diesel particulate filter;

the transient energy balance equation including a number of factors, at least some of the factors including:

a net energy carried by the exhaust stream entering and leaving the control volume;

a heat release rate of the fuel to be dispensed into the control volume by the fuel dispenser taking into consideration a fuel vaporization efficiency and a fuel conversion efficiency at the catalytic converter; and

a heat transfer rate between the catalytic converter and the exhaust stream.

2-25. (Cancelled)

26. (Currently Amended) A method for introducing a reactant into the exhaust stream of ~~a vehicle~~ an exhaust system for a diesel engine, the ~~vehicle~~ exhaust system including a substrate, a

first temperature sensor positioned upstream from the substrate and a second temperature sensor positioned downstream from the substrate, the method comprising:

determining [[the]] a calculated mean temperature of the substrate, the calculated mean temperature of the substrate being calculated and updated on an on-going basis taking into consideration a heat transfer coefficient between the exhaust stream and the substrate, a mass of the substrate, a surface area of the substrate, a specific heat of the substrate and an average temperature of the exhaust stream based on readings taken by the first and second temperature sensors; and

using the mean temperature of the substrate as a parameter for controlling the introduction of the reactant into the exhaust stream.

27. (Previously Presented) The method of claim 26, wherein the substrate is catalyzed to promote a reaction of the reactant at the substrate.

28. (Previously Presented) The method of claim 27, wherein the reactant includes a hydrocarbon fuel, and wherein the hydrocarbon fuel is injected into the exhaust stream at a location upstream from the substrate.

29. (Previously Presented) The method of claim 28, wherein the substrate comprises a diesel oxidation catalyst.

30. (Previously Presented) The method of claim 28, wherein the substrate comprises a lean NOx catalyst.

31. (Previously Presented) The method of claim 28, wherein the substrate comprises a NOx trap.

32. (Cancelled)

33. (Cancelled)

34. (New) The method of claim 1, wherein the catalytic converter and the diesel particulate filter are positioned within an exhaust conduit. wherein the fuel dispenser includes an injector having a housing positioned outside the exhaust conduit for housing the reactant injector, the housing defining an air line port and a reactant line port, the housing also defining a pre-mix region into which the reactant injector injects reactant; wherein the exhaust system includes a reactant line coupled to the reactant line port of the housing for providing reactant to the reactant injector, wherein the exhaust system includes an air line coupled to the air line port of the housing for providing compressed air to the pre-mix region, the reactant from the injector and the air from the air line being mixed at the pre-mix region to form a reactant/air mixture, wherein the exhaust system includes a nozzle for spraying the reactant/air mixture into the exhaust conduit, and wherein the exhaust system includes a mixed reactant/air conduit for conveying the reactant/air mixture from the pre-mix region of the housing to the nozzle.

35. (New) The method of claim 34, wherein a fuel pressure supplied to the injector is 40 to 100 pounds per square inch.

36. (New) The method of claim 34 wherein an air pressure supplied to the pre-mix region is 10 to 50 pounds per square inch.

37. (New) The method of claim 34, wherein a pressure of the fuel supplied to the injector is 30 to 50 pounds per square inch greater than a pressure of the air supplied to the pre-mix region.

38. (New) The method of claim 34, wherein an air pressure regulator in fluid communication with the air line regulates the pressure of the air within the air line.

39. (New) The method of claim 34, wherein a solenoid valve in fluid communication with the air line controls the flow of air within the air line.

40. (New) The method of claim 34, wherein the housing includes a first block and a second block between which the injector is mounted.

41. (New) The method of claim 1, wherein the exhaust system includes a first temperature sensor positioned upstream from the catalytic converter and a second temperature sensor positioned between the catalytic converter and the diesel particulate filter, wherein the fuel dispensing formula includes a calculated mean temperature of the catalytic converter, the calculated mean temperature of the catalytic converter being calculated and updated on an on-going basis taking into consideration a heat transfer coefficient between the exhaust stream and the catalytic converter, a mass of the catalytic converter, a surface area of the catalytic converter, a specific heat of the catalytic converter and an average temperature of the exhaust stream based on readings taken by the first and second temperature sensors.

42. (New) The method of claim 41, wherein the calculated mean temperature of the catalytic converter is calculated by the formula:

$$T_{DOC_n} = \frac{hA_{DOC}\Delta t}{m_{DOC}c_{p_{DOC}}}\left(T_{gas} - T_{DOC_{n-1}}\right) + T_{DOC_{n-1}};$$

where T_{DOC_n} is the calculated mean temperature of the catalytic converter, h is the heat transfer coefficient between the exhaust stream and the catalytic converter, A_{DOC} is the surface area of the catalytic converter, m_{DOC} is the mass of the catalytic converter, c_{pDOC} is the specific heat of the catalytic converter, T_{gas} is the average temperature of the exhaust stream within the catalytic converter, and T_{DOCn-1} is a previously calculated mean temperature of the catalytic converter.

43. (New) The method of claim 42, wherein the fuel dispensing formula comprises:

$$\dot{m}_f = \frac{\left\{\left[\frac{\left(\overline{P}_{cv}V_{cv}c_p\right)_n - \left(\overline{P}_{cv}V_{cv}c_p\right)_{n-1}}{R\Delta t}\right] + \left[\left(\dot{m}_2c_pT_{2_{des}}\right) - \left(\dot{m}_1c_pT_1\right)\right] + hA_{DOC}\left(T_{gas} - T_{DOC}\right)\right\}}{\eta_{vap}\eta_c h_l}.$$

where $\dot{m}_f$ is a calculated fuel mass flow rate for reaching the target exhaust gas temperature, $\overline{P}_{cv}$ is a pressure at the control volume, V_{cv} is a volume of the control volume, c_p is a specific heat of the exhaust stream, R is an ideal gas constant for the exhaust stream, $\dot{m}_1$ is a mass flow rate of the exhaust stream upstream from the catalytic converter, T_{2des} is the target exhaust stream

temperature downstream of the catalytic converter, $\dot{m}_2$ is a mass flow rate of the exhaust stream downstream from the catalytic converter, T_1 is an exhaust stream temperature upstream from the catalytic converter, η_{vap} is the fuel vaporization efficiency, η_c is the fuel conversion efficiency at the catalytic converter, and h_l is a fuel lower heat value.

44. (New) The method of claim 1, further comprising calculating exhaust mass flow for the exhaust system using pressure data provided by a first pressure sensor positioned upstream from a venturi and a second pressure sensor positioned at a restriction of the venturi, and using the mass flow in concert with the fuel dispensing formula to determine the fuel dispensing rate.

45. (New) The method of claim 44, wherein exhaust gas mass flow is determined by a mass flow sensor.

46. (New) The method of claim 44, wherein exhaust gas mass flow is determined by accessing data from an engine controller.

47. (New) The method of claim 1, wherein the desired exhaust gas temperature for causing controlled regeneration at the diesel particulate filter is in the range of 500 to 700 degree Celsius.

48. (New) The method of claim 27, wherein the calculated mean temperature of the substrate is calculated by the formula:

$$T_n = \frac{hA\ \Delta t}{mc}\left(T_{gas} - T_{n-1}\right) + T_{n-1};$$

where T_n is the calculated mean temperature of the substrate, h is the heat transfer coefficient between the exhaust stream and the substrate, A is the surface area of the substrate, m is the mass of the substrate, c_p is the specific heat of the substrate, T_{gas} is the average temperature of the exhaust stream within the substrate, and T_{n-1} is a previously calculated mean temperature of the substrate.